Now the mathematician noticed that in these equations the quantity w occurs divided by g, so he said, Let us call the quotient $\frac{w}{g}$ the "mass" of the body, and denote it by the letter m, so that $w = mg$, equivalent to taking g pounds as the unit of mass.

Unfortunately, in this way the "mass" of a body, which is the measure of an unalterable quantity, is now measured by a variable unit, while the "weight" of a body, which is now defined by the mathematician as the force with which the earth attracts the body, depending on the local value of g, is, although a variable quantity, always represented by the same number—namely, the number of pounds in the body.

This confusion is entirely obviated if, following the engineers, we discard the word "mass" altogether; if we measure, as is customary in ordinary life, weight in pounds, and if we change the unit of force to the absolute unit, called by Prof. James Thomson the "poundal." Now, if a force of p poundals acts on a weight of w pounds, it will produce acceleration a, such that $p = wa$, and then $pt = wv$, and $ps = \frac{1}{2}wv^2$, so that ps, the work done in foot-poundals, has the dynamical equivalent $\frac{1}{2}wv^2$ foot-poundals of energy; not, as the footnote to p. 248 would imply, that $\frac{1}{2}mv^2 = \frac{wv^2}{2g}$, because $m = \frac{w}{g}$, but because $\frac{1}{2}mv^2$ is the kinetic energy in foot-poundals of m pounds moving with velocity v; while the impulse pt second-poundals, has the dynamical equivalent of wv units of momentum.

The unit of momentum has not yet received a name, but the Committee on Dynamics of the Association for the Improvement of Geometrical Teaching is preparing to suggest a distinctive name.

Supposing then that w represents the weight of a body in pounds, how is it possible, as asserted on pp. 219, 220, that $\frac{w}{g}$ remains constant when the body is moved about to parts of the earth where g has different values? and where is the practical value of estimating the effective inertia in terms of the variable unit of mass, as in § 48, when the constant unit of weight would be simpler and practically more intelligible?

These theoretical questions of units of force and weight have been discussed here at some length, as it is important that Prof. Kennedy in his next edition should carefully revise this part of the subject, which will best be done if he disregards the discussions on "mass" of the ordinary text-books, and if he writes always in the ordinary vernacular language used by engineers.

In Chapter XII., on "Friction in Machines," the true laws of friction are given for the first time in any treatise in this country, Morin's illusory laws as usually taught being entirely discarded. With proper lubrication of machinery the question of friction is properly a question of viscous liquid motion. Some interesting applications, with graphical solutions to such problems as friction-brakes and pulley-tackle, are appended, which ought immediately to be incorporated into academical text-books. Of the same nature are the problems on train-resistance in Chapter IX.: a slip on p. 328 of introducing an extraneous factor, π, need only be mentioned here, as the author himself has already corrected it.

We have discussed the dynamical part of the book first, but it is the kinematical part, which treats of mechanism, which forms the greater half of the book. Here the author has analyzed the classification of machines and their elementary parts with great skill and clearness, and illustrated the theory with excellent diagrams. The idea of the "centrode" is largely used in the book, the invention of which is originally due to Belanger. While analyzing fully the centrodes of valve mechanism, the author has mysteriously stopped short of the discussion of valve diagrams, which, in the steam-engine, is the most important practical application of kinematics. Peaucellier's parallel motion is fully described, with Kempe's amplifications: it would be instructive to see a diagram of Peaucellier's motion as applied to an actual steam-engine. Pröll's velocity and acceleration diagrams are carefully explained, with extensions due to the author: this subject has received considerable development of late from German writers, and is capable of solving very elegantly such difficult and important practical problems as, for example, the determination of the bending moment at any point of a connecting rod.

A very useful table of moments of inertia concludes the volume, but here we should prefer to see k the radius of gyration, called in this book the radius of inertia, or rather k^2, the square of the radius, tabulated, side by side of the corresponding area A or volume V.

In conclusion, Prof. Kennedy's students are to be congratulated on the possession of such an admirable text-book, and it is to be hoped that the style and influence of its teaching will make itself widely felt outside of professional circles.

A. G. GREENHILL.

THE SOLOMON ISLANDS.

The Solomon Islands and their Natives. By H. B. Guppy, M.B., F.G.S., late Surgeon R.N. (London: Swan Sonnenschein, Lowrey, and Co., 1887.)

THE Solomon Islands, whether we consider the romantic narratives of their discovery and rediscovery, the comparatively unsophisticated character of their inhabitants, their faunistic and floral relationships, or their remarkable geological structure, are of more than common interest to the scientific world, and it is a matter for congratulation that their description has been undertaken by a traveller and historian so eminently qualified for the task as is Dr. Guppy. The book which he has produced is a rich storehouse of interesting and important observations, and will henceforth be an indispensable work of reference to every student of the races inhabiting the Pacific islands. It is worth while to lay stress upon this fact for the sake of encouraging future travellers to give their observations to the world, because Dr. Guppy did not at first intend to make any special investigation of the habits and manners of the inhabitants, but was led to do so by the want of interest displayed by those who seemed to have so much better opportunities.

The Solomon Islanders seem to be of various types in different parts of the group, but their prevailing characters are distinctly Melanesian or Papuan. A circumstance is pointed out which seems to indicate the Indian Archipelago as having been the route by which the Eastern Polynesians reached the Pacific. This circumstance

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consists in the possibility of tracing the native names of certain trees across the Central Pacific from the Indian Archipelago to the Austral and Society Islands. For instance, in the former locality the *Barringtonia speciosa* goes by the names of *Boewa boeton* and *Poetoen;* in the islands of the Bougainville Straits in the Solomon Group it is called *Puputu;* in Fiji, *Vutu;* in Tonga, *Futú;* and in the Hervey and Society Islands, *E-Hoodu* or *Utu.* The name thus appears to have undergone a kind of progressive modification as the tree has receded from its original home. The large amount of information which Dr. Guppy has been able to collect is mainly due to his remarkable tact in dealing with the natives: he seems to have at once succeeded in establishing friendly relations with all those with whom he came in contact, and though he was continually in their power, going long journeys with no other escort than a body of them, he met with nothing but kindness at their hands. He modestly ascribes this satisfactory result mainly to the soothing influences of tobacco, without which, he says, the white traveller in these islands "is worse off than a man without any money in his purse in London," but something must undoubtedly be attributed to the kindly and conciliatory personal influence of the writer himself.

Where so much excellent matter is given it seems ungrateful to ask for more, but it is impossible to repress the desire for knowledge regarding the dwellers in the interior of these islands, who seem to be always at war with the coast tribes, and are regarded by them with so much contempt that "man-bush" is with the latter a common term of reproach. Very interesting, too, are the worked flints, not unfrequently found in the soil either during agricultural operations or after heavy rains. They may probably have been the work of the primitive Negrito race which was at one time widely spread over this region of the globe. It is worthy of notice that in none of the islands visited by the author was any chalk found which contained flints, but there are records of its existence in Ulaua, another member of the group.

Two chapters, certainly not inferior to the rest of the work in interest, are occupied by a history of our knowledge of this group of islands. It does not often happen that one who has distinguished himself as an explorer is willing to undertake a piece of literary work, calling for the patient and critical examination of an old manuscript, but it is a peculiarly happy chance that has thrown the translation of Gallego's journal into the hands of one whose exceptionally accurate knowledge of the locality has no doubt enabled him to avoid errors into which the best of scholars without such information must have fallen. Hernando Gallego was chief pilot to an expedition which was despatched from Peru under the command of Alvaro de Mendana for the ostensible purpose of spreading the Christian faith among the islanders of the Pacific. In the year 1567 they reached the Solomon Islands and gave names to most of them, but lest the English should attempt to possess themselves of the newfound territory no account of the discovery was published; and hence, after one or two futile attempts on the part of the Spaniards to refind and colonize them, knowledge of their whereabouts gradually became a vague tradition, and at length even their very existence was doubted. Two hundred years elapsed before Carteret sighted and anchored off the group, but he did not land. Then in rapid succession came the discoveries of Bougainville, Surville, Maurelle, and Shortland, but none of these identified their discoveries with the previous work of the Spaniards, and it was reserved for the genius of Buache to point out "that, between the extreme point of New Guinea as fixed by Bougainville and the position of Santa Cruz as determined by Carteret, there was a space of 12½° longitude, in which the Islands of Solomon ought to be found." His conclusion, that the islands seen by Carteret and others were the same as those previously discovered by the Spaniards, though long disputed, is now generally admitted, and justice has been rendered both to the gallant explorers and to the laborious and gifted investigator.

In reading this journal it is impossible not to wish that the chart accompanying the volume were on a somewhat larger scale, that more names had been inserted, and that the author, even if he did not feel at liberty to restore those given by the original discoverers, had at all events inserted them within parentheses.

Of Dr. Guppy's work in natural history it would be difficult to speak too highly. It embraces, in addition to a mass of anthropological material, to which reference has been made above, a general account of the chief divisions both of the animal and vegetable kingdoms. Special attention may be called to the observations upon floating seeds and seed-vessels, which have been utilized by Mr. Botting Hemsley in his work on the oceanic dispersal of plants, and to a remarkable fungous growth (*Pachyma?*) found lying loose upon the soil. Of reptiles, batrachians, and mollusca many new species were obtained; an interesting discussion is given regarding the origin of the edible birds'-nests, and an account of attempts to ascertain by direct evidence whether the *Birgus latro* is really able to husk and break cocoa-nuts for itself, as well as details of experiments on the power of various animals to resist submersion in sea-water. The Solomon Islands stand in a remarkable zoo-geographical position, on the boundary between the Polynesian and Indo Malayan regions, hence a special interest attaches to these lists of species and biological data. The size of the author's collections is little short of marvellous when it is remembered that for two out of the three years spent there his own cabin was the only place where he could store them. He seems, indeed, to have met with but scanty encouragement from those quarters whence he might reasonably have expected it, and every Briton should blush when he reads and reflects upon the truth of the closing words of Dr. Guppy's Introduction:—

"Stifling my own patriotic regrets, I cannot but think that the presence of Germany in these regions will be fraught with great advantage to the world of science. When we recall our spasmodic efforts to explore New Guinea and the comparatively small results obtained, when we remember to how great an extent such attempts have been supported by private enterprise and how little they have been due to government or even to semi-official aid, we have reason to be glad that the exploration of these regions will be conducted with that thoroughness which can only be obtained when, as in the case of Germany, geographical enterprises become the business of the State."

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